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Trends and progress in the field of environment and development: emerging and persistent issues in water resources management

Emerging and persistent issues in water resources management

Note by the secretariat

Summary

The present document reviews the challenges associated with access to basic water and sanitation in Asia and the Pacific, as well as the emerging threats to water resources management, particularly those associated with urbanization and the water-food-energy nexus.

Access to clean water for domestic use, cooking, and personal hygiene and to improved sanitation are essential for a healthy and productive population and for environmental sustainability. The Asia-Pacific region has made substantial progress with respect to both the water and sanitation targets of the Millennium Development Goals, but more efforts are necessary to meet the sanitation target in particular. Sustainability of achievements is also under question, as water resources and water infrastructure are threatened by the impact of climate change. Household water security can be achieved only if these concerns are addressed for all households in Asia and the Pacific.

The threats to water resources management are further compounded by the interplay between water, food, and energy security. Asia and the Pacific uses more water for agriculture than any other region of the world. Water is needed to produce food for the region's fast-growing economies, but also for all other economic activities, including hydro-power generation. Water quality is also threatened, as, for the most part, wastewater from rapidly growing urban centres remains untreated.

The Committee is invited to deliberate on these issues and provide the secretariat with guidance on the direction of its future work, specifically with respect to the water-food-energy nexus and its implications for household water security and for integrated water resources management.

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I. Introduction

Igniting the fire and tending the flame for a water-secure Asia-Pacific region

1. The Asia-Pacific region has the largest land area in the world and with it comes an impressive endowment of 21,135 billion cubic metres of renewable freshwater resources. Although absolute natural endowment is high, the region's natural water resources support about 60 per cent of the world's population with 38 per cent of the world's water resources. With this uneven distribution between supply and demand, the Asia-Pacific region faces uncertainties regarding water, which is essential for inclusive and sustainable development.

2. Poor household access to water and sanitation, water pollution, the impact of urbanization, water-related natural disasters and extreme weather patterns paint a complex and worrisome picture.

3. Access to clean water for domestic use, drinking, cooking, and personal hygiene as well as access to basic yet effective sanitation are essential to

maintaining a healthy population and environmental sustainability. Ensuring access to safe water and sanitation catalyses many aspects of human development. This message is clearly articulated through the Millennium Development Goals, one of the targets of which is to reduce by half the proportion of people without sustainable access to safe drinking water and basic sanitation. In support of the Millennium Development Goal target, the General Assembly declared in July 2010 that access to safe and clean drinking water as well as sanitation is a human right essential to the enjoyment of life and all other human rights. However, clean water has become scarce, and the poor in particular continue to suffer from water pollution, water shortages and the lack of adequate sanitation. In 2008, about 460 million people in Asia and the Pacific lacked access to improved water resources, while 1.8 billion were without access to improved sanitation facilities.

4. The economic, health, and other costs of water contamination are high. The cost of air and water pollution in Jakarta probably exceeds \$1 billion a year, and in Bangkok it is more than \$2 billion.¹ In March 2005, officials in Beijing noted that 70 per cent of China's rivers and lakes were polluted.² Environmental experts fear pollution from untreated agricultural and industrial waste could turn the Yangtze into a "dead river" within five years. A 2006 desk review study found that more than 60 per cent of lakes in Malaysia are eutrophic. Water pollution in Asian cities is largely caused by domestic sewage but is compounded by industrial wastes. Comprehensive water resource management will be one of the most difficult issues in Asia in coming years. Such an approach must encompass all demands — industrial and agricultural as well as urban — on water resources. The health and welfare impacts of urban water pollution have to be tackled on two fronts: provision of a safe water supply and reduction of effluents. The involvement of the public and private sectors together with community participation are needed to solve this problem.

5. As Asia urbanizes, pollution problems grow even more urgent. The Department of Economic and Social Affairs estimated that more than 50 per cent of the population in the Asia-Pacific region will be concentrated in urban areas by 2025.³ Rapid urbanization and mushrooming slums are exerting additional pressure on the capacity of cities to meet the unprecedented demand for water resources and wastewater facilities. Pollution of water bodies becomes more pronounced with the migration of people to urban areas.

6. Physical water scarcity is only one part of the equation. Water allocation is another matter. Water for agriculture is by far the main consumer of water in the region, while commercial and industrial use is increasing steadily. The accelerating impact of changing weather patterns and extreme weather events on water resources is increasingly linked to expanding food and energy resource challenges, especially in countries that already have vulnerable populations and inefficient patterns of resource use.

7. Observed changes in climatic conditions, such as rising temperatures over several decades, have been linked to changes in the large-scale

¹ Brandon, C and R Ramankutty. 1994. "As Asia urbanizes, pollution problems grow ever more urgent". *The New York Times*. <<http://www.nytimes.com/1994/01/04/opinion/04iht-edbrand.html?pagewanted=print>> Accessed 22 August 2011.

² Lim, L. 2005. "China warns of water pollution". *BBC News Asia Pacific*. <<http://news.bbc.co.uk/2/hi/asia-pacific/4374383.stm>> Accessed 22 August 2011.

³ United Nations, Department of Economic and Social Affairs, Population Division. 2006. *World Urbanization Prospects: The 2005 Revision*. Working Paper No. ESA/P/WP/200.

hydrological cycle such as: increasing atmospheric water vapour content; changing precipitation patterns, intensity and extremes; reduced snow cover and widespread melting of ice; and changes in soil moisture and runoff.⁴ In Asia and the Pacific, hydrologic extremes have steadily increased. Changes in weather patterns influence precipitation, temperature and potential evapotranspiration, as well as the occurrence and severity of droughts. Melting glaciers and sea level rise are additional threats.

8. Water hazards, resulting from floods and waterlogging or from droughts, are likely to increase in the future and require better disaster management in the region. A study of historical flood records in China illustrates that, along with population growth, the occurrence of flood disasters has also increased, suggesting that an increasing number of people are living in vulnerable, flood plain locations. Floods and storms bring loss of life and huge economic costs. The Intergovernmental Panel on Climate Change (IPCC) identifies the small island States, the Asian mega-deltas and the coastal urban centres (many in Asia) as vulnerable zones.

9. Given the effects of extreme weather events coupled with inefficient water management in the region, inadequate political will, and inadequate investments, the Asia-Pacific region is heading towards an era of water scarcity that threatens the prospects for socioeconomic development, unless significant efforts are made for efficient and integrated water resources management (IWRM). Given the emerging and persistent challenges on the region's water resources, eco-efficient and effective water use can be achieved through the application of IWRM principles, which are guided by a comprehensive vision of sustainable water management. IWRM-compliant water management strategies and implementation plans can address the issues and needs of the three dimensions and pillars of sustainability — the environment, society and economy.

10. Water and energy are needed for all economic activities. Agriculture uses an average of 80 per cent of the surface water in Asia and the Pacific. While mindful of the specific need of each subsector, water required for all services is extracted from the same natural water systems into which the untreated wastewater from these economic activities is discharged. The ESCAP secretariat is currently analysing the policies that would be required in terms of a water-food-energy nexus for a water-secured Asia and the Pacific.

11. The ESCAP secretariat remains committed to assisting member countries in addressing the challenges in the water sector in the region. The secretariat's vision is for ESCAP to be the key driver of regional cooperation in water resources management and to serve as a knowledge hub on persistent and emerging issues related to water resources management, especially those requiring priority action at the regional level, for the purpose of achieving inclusive and sustainable development in Asia and the Pacific.

12. The ESCAP secretariat is continuing to build a platform for policy-related exchanges and development in the region. It is fully committed to supporting the Asia-Pacific Water Forum (APWF) in the preparation and organization of the Second Asia-Pacific Water Summit (APWS) and the Sixth World Water Forum (WWF). ESCAP is a member of UN-Water, which is working as one United Nations on issues of water policies. ESCAP leads the

⁴ Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., "Climate change and water". *Technical Paper of the Intergovernmental Panel on Climate Change*, IPCC Secretariat, Geneva, 2008.

4th key result area of APWF, the intersectoral dialogue on monitoring investment and results in the water sector for Asia and the Pacific, to identify potential frameworks for monitoring investment and results and the potential development of supporting tools for the water-related Millennium Development Goals and investments.

II. Emerging and persistent issues in water resources management

A. Household water security: making its way beyond access to safe water and basic sanitation

13. From the simple definition of the World Health Organization (WHO) as having a “reliable availability of safe water in the home for all domestic purposes”, household water security as an issue has evolved to more encompassing areas, such as human rights, health, pollution, equity and food security.⁵

14. To better understand household water security and to adequately measure and assess it, it is important to look beyond drinking water and sanitation access because household water security is more than just about sustaining life: it is considered a requirement for improving the quality of life. Household water security means having the capacity to deliver expected desirable results and outcomes from investment and management in water resources for socially inclusive, environmentally sustainable economic development.

15. This new understanding of household water security has been championed by the APWF. During the first APWS, which was organized by APWF, a consensus emerged on the need to support regional efforts to meet the Millennium Development Goal Target 7C on water and sanitation. More than covering a basic need, water is a boon to human development, raising productivity and allowing small household businesses to flourish. Adequate sanitation also allows an increase in human capabilities, through improved health, education and employment opportunities.

B. Sustainable access to water and sanitation: so much done, so much more to be done

1. Access to safe water

16. The percentage of people in the Asia-Pacific region with improved water supply is steadily increasing, from 74 per cent in 1990 to 82 per cent in 2000 and at 89 per cent in 2008. The progress can be largely attributed to infrastructural water investments and developments in the following subregions: East and North-East Asia, South-East Asia, and South and South-West Asia. The current rate of increase places the Asia-Pacific region slightly behind Latin America and the Caribbean, which for years has shown the highest access rate among developing regions in the world. The region is still ahead of Africa, which had an access rate of 65 per cent in 2008.

⁵ World Health Organization. 2003. *World Health Day – Household Water Security*. <<http://www.emro.who.int/whd2003/kit-brochure-part4-water.htm>> Accessed 7 June 2011. WaterAid. 1999. *Boiling Point: Issues and Problems in Water Security and Sanitation*. A WaterAid Briefing Paper. <http://www.wateraid.org/documents/water_security.pdf> Accessed 7 June 2011.

17. Two subregions — East and North-East Asia and North and Central Asia — are currently leading the Asia-Pacific region in providing access to safe drinking water to approximately 90 per cent of its population. With the exception of Mongolia and Tajikistan, which had access rates of 76 per cent and 70 per cent, respectively, in 2008, the countries in these two subregions are on track to halving the proportion of population without access to safe water.

18. Although the Pacific subregion maintains a proportion of the population with access to improved water sources higher than the global average, it regressed from 90 per cent access rate in 1990 to 88 per cent in 2008. The relapse has been mainly driven by the sluggish investment on water infrastructure that will expedite delivery of safe and potable water to a majority of the population. In 1990, there were more than 3 million Pacific islanders without access to safe drinking water. In 2008, an additional 1.6 million people in the Pacific islands did not have the privilege of using potable water.

19. Despite the increase in the number of people with no adequate access to improved water sources in the Pacific island developing economies, more than 90 per cent of the urban population in all the subregions in Asia and the Pacific receive sufficient access to safe water sources. Between 1990 and 2008, Cambodia and Mongolia showed the greatest percentage increase in providing access to water in the urban area with 29 per cent and 16 per cent improvement, respectively. Myanmar, Nepal, Marshall Islands and Papua New Guinea, on the other hand, have regressed in their pursuit to provide greater access to adequate sources of water in the urban areas. In 2008, only 75 per cent of the urban population in Myanmar received adequate access to safe water as compared with 87 per cent in 1990. The large fall can be partly attributed to political turmoil as well as the recent natural disasters that struck the country.

20. Between 1990 and 2008, the proportion of rural population with access to improved water sources increased by 19 per cent. Despite this progress, access to improved water services in rural areas is 13 per cent less than that in urban locations in the region. Several initiatives have been launched to address the discrepancy between rural and urban areas, but efforts to level up with the development made in the urban areas still fall short.

Table 1
Access to safe drinking water

Subregion	2000		2008	
	Population (thousands)	Percentage	Population (thousands)	Percentage
Central Asia with access	200 291	92	202 088	93
North-East Asia with access	1 214 112	82	1 395 991	90
Pacific islands with access	27 517	88	30 673	88
South-West Asia with access	1 247 509	82	1 515 162	87
South-East Asia with access	414 154	80	493 042	86
Asia-Pacific region with access	3 103 582		3 636 956	
Asia-Pacific region without access	664 609			

Source: Calculation by the ESCAP secretariat, based on the Joint Monitoring Programme for Water Supply and Sanitation, 2010, available at: www.wssinfo.org/datamining/introduction.html, accessed on 10 May 2010.

21. All the subregions with the exception of the Pacific subregion deliver safe water to more than 80 per cent of rural inhabitants. In China alone, access to water in the rural areas increased from 56 per cent in 1990 to 82 per cent in 2008. In the same period, Mongolia also made significant progress in increasing the proportion of people with access to safe drinking water in rural locations: from 27 per cent to 49 per cent. In South-East Asia, Viet Nam has taken the lead for the subregion by raising the access rate from 51 per cent in 1990 to 92 per cent in 2008, nearly double. Myanmar and Cambodia are also making notable progress in providing access to the rural population.

22. The lack of access to safe drinking water remains a burden for the rural population of the Pacific island developing economies. In 2008, an additional 1.4 million Pacific islanders in the rural areas lack access to improved water services. From 65 per cent of the rural population in the Pacific subregion having access to safe water in 1990, only 58 per cent have maintained access in 2008. For example, in Papua New Guinea between 1990 and 2008, the proportion of the rural population with access to clean water increased by only one percentage point.

23. There are clear trends indicating progress in providing access to improved water sources in both the urban and rural areas. The region is currently on track to meet the Millennium Development Goal targets in the urban areas. However, if the current rate of progress remains unchanged in the rural locations, the region might miss the 2015 water access target. It is hoped that the recent General Assembly declaration of access to clean drinking water as a human right will resonate throughout Asia and the Pacific and that the region will be on track to meeting its target in the next four years.

2. Access to basic sanitation facilities

24. To emphasize the importance of adequate access to basic sanitation services, the General Assembly in its resolution 61/192 decided to declare 2008 the International Year of Sanitation. Massive campaigns to engender provision of lowest-cost technology that will ensure hygienic excreta and sillage disposal and a clean and healthful living environment both at home and in the neighbourhood of users were launched globally. With these initiatives, the proportion of people using improved sanitation facilities is expected to show significant progress in support of the Millennium Development Goal sanitation target.

25. The population growth rate presents a problem. From 1990 to 2008, the global proportion of people with access to basic sanitation facilities increased from 53 per cent to 61 per cent, with approximately 1.3 billion people gaining access to improved sanitation. Over the same period, however, the world's population increased from 5.3 to 6.7 billion, effectively nullifying the gains in access to basic sanitation facilities, which augurs poorly for the world meeting the Millennium Development Goal sanitation target by 2015.

26. The Asia-Pacific region has made modest progress in halving the proportion of people without improved sanitation. From 43 per cent in 1990, the region has increased the proportion of its inhabitants with access to basic sanitation to 54 per cent, which is 7 per cent below the global average. Nevertheless, more than 1.8 billion people still lack access to basic sanitation facilities. Remarkably, 70 per cent of the world's 1.1 billion open defecators are in Asia. South and South-West Asia as well as the Pacific islands continue to lag behind in providing improved sanitation services. From 1990 to 2008, an additional 129 million people lack access to sanitation facilities in South and South-West Asia. This is primarily driven by the higher population growth rate

in the subregion compared to the low delivery rate of sanitation improvements. The Pacific subregion regressed from an 88 per cent provision rate in 1990 to an 86 per cent rate in 2008, representing an additional 1.8 million people lacking basic sanitation services.

27. The South-East Asian subregion continues to make strides towards meeting the Millennium Development Goal sanitation target by 2015. The subregion registered a 24 per cent increase in the proportion of people with access to basic sanitation services between 1990 and 2008. Myanmar and Viet Nam made the greatest leap over the same period. From 23 per cent access rate in 1990, Myanmar is now providing basic sanitation facilities to 81 per cent of its population. In 2008, Viet Nam has sanitation access coverage for 75 per cent, which is 40 per cent more than the 1990 access rate.

Table 2
Access to basic sanitation in Asia and the Pacific

Subregion	2000		2008	
	Population (thousands)	Percentage	Population (thousands)	Percentage
Central Asia with access	189 818	87	192 180	88
North-East Asia with access	815 267	55	925 595	60
Pacific islands with access	27 037	88	30 348	86
South-West Asia with access	517 532	34	659 207	38
South-East Asia with access	306 150	45	395 345	69
Asia-Pacific region with access	1 855 804		2 202 675	
Asia-Pacific region without access	1 912 387			

Source: Calculation by the ESCAP secretariat, based on the Joint Monitoring Programme for Water Supply and Sanitation, 2010, available at: www.wssinfo.org/datamining/introduction.html, accessed on 10 May 2010.

28. With rapid urbanization in Asia and the Pacific, reaching the Millennium Development Goal sanitation target by 2015 requires unprecedented efforts at the regional, subregional and national levels. Between 1990 and 2008, basic sanitation coverage in the region's urban locations increased by only three percentage points. With an urban population growth rate that is increasing faster than the sanitation coverage rate, the region actually regressed in providing sanitation services to its urban inhabitants. From 1990 to 2008, an additional 164 million people in urban locations lack access to basic sanitation. The slow progress in increasing the rate of basic access to sanitation facilities can be noted in all the subregions except South-East Asia, which has increased the access rate by 10 per cent over the last two decades. In 2008, China, Bangladesh, India and Nepal maintain an urban coverage rate below 60 per cent, which is more than 17 percentage points lower than the global average.

29. Compared with urban locations, the rural areas in the region have made steady progress in increasing the proportion of inhabitants with basic sanitation coverage. From 31 per cent in 1990 to 38 per cent in 2000, the average rural coverage rate had increased by 2008 to 44 per cent, which is only one percentage point shy of the global average. Over the same period, the South-East Asian subregion registered the greatest rural sanitation percentage point increase, at 26 per cent.

30. From 1990 to 2008, the East and North-East Asian subregion logged a 13 per cent growth in rural sanitation coverage. In the same period, the South and South-West Asian subregion showed a modest increase of 14 per cent in the rural locations. However, 6 out of its 10 member States have a coverage

rate lower than 60 per cent in 2008. India and Pakistan only achieved rural sanitation coverage rates of 21 per cent and 29 per cent, respectively, in 2008. The outlook for the Pacific subregion continues to be bleak as an additional 1.5 million people from the rural areas lacked access to basic sanitation services in 2008.

31. Reaching the Millennium Development Goal sanitation target will require an unequivocal effort since the current trend does not look very promising. The message that inadequate access to basic sanitation facilities coupled with poor hygienic practices can spread waterborne diseases to thousands of children every day and lead to impoverishment and diminished opportunities for thousands more should resonate not only with governments but also funding agencies. These problems can be avoided with active private sector participation, through enabling regulations that can provide adequate incentives to help eliminate barriers to investments.

C. Urbanization vis-à-vis extreme weather events: a bane or a boon for the Asia-Pacific region's water resources?

1. Rising populations and growing demand for water resources

32. Asia's urban population increased from 31.5 per cent in 1990 to 42.2 per cent in 2010, which is the highest percentage increase among all the regions of the world.⁶ By 2015, the percentage of the global population living within large Asian mega-cities with populations of 10 million or more and large cities with populations of 5-10 million is expected to grow by 4.7 per cent and 3.7 per cent, respectively. Areas with dense urban populations of 500,000 or less will make up 27 per cent of the global population by 2015. By 2025, 59 per cent of the population in the region will be living in urban areas. The massive urbanization will present a new set of water management challenges in the coming decades.

33. Meeting urban water needs also has serious economic, social and political dimensions. Urban water demand comes from the concentration of people who need water to survive and for their economic activities. With the unprecedented migration of people to urban areas in Asia and the Pacific, the unequal distribution of water resources rises continuously, and water availability is complicated by physical, economic and environmental water scarcity.

34. Rapid urbanization without proper planning entails a myriad of water-related issues. Inadequate waste and wastewater management systems cause pollution of surface water resources in many cities in the region. This problem is particularly acute in the region's urban slums, where the infrastructural development focus has been on ensuring adequate supplies of water without appropriate consideration for water supply safety and security, water treatment and disposal, or demand management.

35. Surface water is not the only water source that has the potential to be tainted by pollution due to urbanization. With approximately 32 per cent of the region's population obtaining drinking water from groundwater resources, the likelihood of contamination is very high. The United Nations Environment Programme (UNEP) in its 2006 Global International Water Assessment estimated that half of the 24 Asian and Australian national subregions are

⁶ United Nations Human Settlements Programme, *The State of Asian Cities 2010/11*, Regional Office for Asia and the Pacific. <<http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=3078>> Accessed 7 June 2011.

severely polluted. The assessment further estimated that the condition of 17 areas would decline by 2020, with only the Mekong River and Southern Australia watersheds projected to improve.

36. The prospect of better public facilities and the associated economic dynamism of cities encourage migration. The environmental constraints should not be ignored, however. Urbanization can generate benefits for the growing population of Asia and the Pacific as long as proper planning ensures that limited resources, such as water, are utilized and managed efficiently.

2. Extreme weather events in Asia-Pacific urban areas: expanding threats and limiting opportunities

37. Precipitation in many Asia-Pacific countries is heavily influenced by the monsoon climate. In some river basins and regions, the fluctuation of rainfall and runoff can be 5 to 10 times greater than previously recorded. Water-related natural disasters, such as floods and droughts, are undermining economic development in many Asia-Pacific countries. Coastal areas, where much economic growth is generated, are often struck by typhoons and rainstorms. Striking and sustaining an optimal balance between the development needs of many economies in the region and the risks associated with the use of flood-prone land is a challenge, given existing institutional structures and uncertainties concerning the future state of the water regime.

38. The impacts of climate change have increasingly gained clarity in recent years, particularly in water-related sectors. Hydrologic extremes have increased in Asia and the Pacific as well as globally. Observed warming over several decades has been linked to changes in the large-scale hydrological cycle, such as changing precipitation patterns.⁷ Increased intensity and variability of precipitation are projected to elevate the risks of flooding and droughts and to cause seasonal changes to river flows.

39. Changes in the weather patterns influence the occurrence and severity of floods and droughts. Deaths and material damage from extreme floods and more intense droughts can be high, affecting increasing numbers of people. Water hazards, resulting from floods and waterlogging or from droughts, are likely to increase in the future, thereby requiring better disaster management in the region.

40. Extreme weather events are strongly related to the water balance, changes in snow cover, melting glaciers as well as sea level rise. The “dual impact” in deltas and estuaries (that is, lower flow and sea-level rise) needs more attention. North-western China is projected to experience a 27 per cent decline in glacial areas. Changes in runoff could impact power output from hydropower-generating countries, such as Tajikistan. The impact in deltas and estuaries is made worse by the impact of dams stopping sediment transport, which leads to subsiding deltaic regions, adding to the impact of sea level rise.

41. As demand for agriculture water in arid and semi-arid regions of Asia is continuously increasing, saltwater intrusion in estuaries is expected to move further inwards. Snow melt and glaciers, as well as rising snow lines, could also be unfavourable for both upstream and downstream agriculture in South and Central Asia.

⁷ Bates, B.C., Z.W. Kundzewicz, S. Wu and J.P. Palutikof, Eds., “Climate change and water”. Technical Paper of the Intergovernmental Panel on Climate Change, IPCC Secretariat, Geneva, 2008.

42. Adaptation measures that try to capture more water storage may make the situation in deltas even worse.

43. Countries in Asia and the Pacific, especially areas with high population density, are expected to be severely affected by increased climate variability. For example, in the Mekong River, the maximum flow is projected to increase by 35-42 per cent in the basin and 16-19 per cent in the delta. In contrast, the minimum flows are estimated to decline by 17-24 per cent in the basin and 26-29 per cent in the delta, suggesting possible water shortages in the dry season. With rapid urbanization, the already heavily populated mega-deltas in South-West, East and South-East Asia are expected to experience greater loss of life and property due to increased river and coastal floods.

44. Floods and storms bring loss of life and huge economic costs. Substantial financial and other development resources are being diverted each year to post-disaster relief, emergency assistance, reconstruction and rehabilitation. The risks related to poorly managed extreme weather events also exact an indirect toll by discouraging private investment. With extreme weather events and inadequate disaster risk management, investors lack reliable infrastructure, predictable human resources, and stable markets needed to promote investment strategies that will help increase people's resilience in facing the challenges of extreme weather events coupled with increasing competition for water resources. Although flood mitigation infrastructure keeps improving, rapid economic development and occupation of floodplains means that floods result in greater loss.

45. The unprecedented increase in climate extremes, if not appropriately handled, will diminish much of the gains achieved in poverty eradication in the region.

D. Connecting the dots: pollution, urbanization and extreme weather events

46. Some parts of the region are already experiencing significant stress or shortfalls on water resources and future demand. The ever teetering balance between water demand and availability has reached a critical level due to massive abstraction and prolonged periods of low rainfall or drought. In addition, more extreme events are already being observed, including heavy rainfall, flooding, and low flow and drought conditions.

47. According to IPCC, while some areas of the region are likely to experience a decrease in precipitation, the tropics and those in the high latitudes are expected to see increasing amounts of precipitation, which will increase susceptibility to flooding, soil erosion, and movement of land mass. Less precipitation and warming in some countries with a subtropical climate, on the other hand, will accelerate the rate of surface drying. This will leave less water moving in the layers of soil near the surface, leading to reduced downward movement of water and less replenishment of groundwater supplies.⁸ All these factors will affect agricultural productivity, land values and the habitability of an area, which would have a significant influence on the key economic components of the region.

48. Acute and critical pollution of natural water bodies is experienced across the region. With the intensity of extreme hydrologic events due to

⁸ Nearing, M.A., Jetten, V., Baffaut, C., Cerdan, O., Couturier, A., Hernandez, M., Le Bissonnals, Y., Nichols, M.H., Nunes, J.P., Renschler, C.S., Souchere, V. and Van Oost, K., 2005, "Modeling response of soil erosion and runoff to changes in precipitation and cover", *Catena* (61), pp. 131-154.

climate change increasing more frequently, the impact of pollution will be amplified as polluted flood waters spread across the land mass more frequently. In times of drought, natural water bodies, which are the sources of the water supply, will have even higher concentrations of pollutants, possibly making them unsafe. Constraints on access to water will be exacerbated, which may result in backtracking on the gains already made with regard to the Millennium Development Goal targets. Rapid urbanization will add to the complexity of this already acute condition; hence, there is a need for rethinking in favour of holistic management of water resources to ensure water security across the region.

49. Extreme weather events, population growth, and rapid urbanization in the region will cause major changes in terms of the quantity, quality and accessibility of water, and the efficiency of water services. These socio-economic and climatic transformations over the decades ahead, some of which are already unavoidable, will bring with them the challenge of building resilience and/or adapting to the associated impacts on water resources. Not taking action will have an impact on the region's disaster risks, food, water and energy security, with serious repercussions on socio-economic development that will be felt by the entire Asia-Pacific region.

E. Putting the pieces of the puzzle together: water, energy, and food nexus

50. Water underpins all socio-economic activities. The availability and quality of water are paramount for environmental health, societal well-being and a thriving economy. Specifically, for a region such as Asia and the Pacific, where agriculture makes a significant contribution to economic growth, access to quality water resources is essential.

51. An adequate water supply is critical for food security and for sustaining agricultural communities that provide food for the world's growing population. Water is used to irrigate crops and feed livestock. Groundwater, in particular, supplies significant amounts of water for agricultural production, especially in arid lands that do not have access to surface-water sources. Water is also used to process food; whether for removing soil particles from newly harvested vegetables or cleaning up after milking livestock, sanitation expectations require significant use of water.

52. Asia and the Pacific uses more water for agriculture than any other region of the world. At the same time, the region's population has increased 30 per cent over a period of 25 years and will rise another 25 per cent by 2035.⁹ In a business-as-usual scenario, even more water will be needed to produce the additional food necessary to sustain the rapidly increasing population. By 2030, annual water demand for the Asia-Pacific region is predicted to increase by 55 per cent compared with 2005.¹⁰ The supply side of the food equation is being constrained by diminishing agricultural productivity gains, competing use of available land due to increasing urbanization and industrialization, biofuel production, global warming and water scarcity. Alternatively, the use of water must be made more efficient and sustainable in view of limited global, regional and national capacity.

⁹ United Nations Human Settlements Programme, *The State of Asian Cities 2010/11*, Regional Office for Asia and the Pacific. <<http://www.unhabitat.org/pmss/listItemDetails.aspx?publicationID=3078>> Accessed 7 June 2011.

¹⁰ McKinsey & Company. 2009: *Charting Our Water Future: Economic Frameworks to Inform Decision-Making*. 2030 Water Resources Group. <http://www.2030waterresourcesgroup.com/water_full/Charting_Our_Water_Future_Final.pdf?> Accessed 7 June 2011.

53. It is clear that food production is impossible without water, and water cannot be distributed effectively for large-scale agricultural production without economic intervention that would allow for its effective and sustainable distribution. Thus, water affects food prices in particular and economic security in general. Food security and water availability issues are therefore inextricably linked, and their linkage must be sustainable at various levels of economic development. Water resources are among the most important factors driving the current changes in food security, affecting nations as well as local communities.

54. The high population growth rate in Asia and the Pacific, coupled with rising water pollution and scarcer water resources, creates a growing imbalance between soaring demand and uncertain supply not only in the food and water sectors but also in the energy sector. The region's increasing population is straining the ecological systems that provide water for drinking, food production and other life-sustaining services. As a scarce water supply is a natural limit to the steady economic growth taking place in many parts of the region, the time has come for the region to place the water, energy and food nexus at the centre of economic development debates as it has long remained on the periphery.

55. Incorporating energy into the picture highlights the importance of water as a central part in the water, energy and food nexus. Hydropower is heavily reliant on water inflows and, hence, to precipitation and the upstream management of resources. The potential for hydropower is relatively strong in Asia and the Pacific compared to other regions of the world, with over 295,764 MW total installed capacity in 2008.¹¹ It is expected that cumulative hydro installed capacity in Asia and the Pacific will grow at a compound annual growth rate of 6.92 per cent to reach 434,388 MW by the end of 2013. This technology in some instances cuts down the quantity of water available downstream, and has an impact on the quality of water upstream through siltation. Large hydropower installations can have a considerable impact on agriculture and food production through their effects on the quantity and the quality of water available upstream and downstream.

56. Water is not only relevant to hydropower energy production; it is also utilized in virtually all types of energy production. The extraction of coal, oil, natural gas and uranium requires water. Thermal power needs water for steam production and/or cooling. Silicon solar panels use water in production. In turn, groundwater abstraction, lifting and conveyance as well as desalination and wastewater treatment need energy. Energy production is the greatest industrial user of water, and increasing energy production necessitates increased access to freshwater. In that regard, the Asia-Pacific region's energy demand is projected to increase by about 70 per cent by 2030.¹²

57. To ensure sustainable and inclusive growth in the region, there is a need to integrate considerations for the management of water resources, sources of energy and food production. Energy security in the region therefore calls for sufficient availability of water resources, which, in turn, depends on rising amounts of affordable energy. Water and energy can no longer be considered separate challenges; even in fossil-fuelled or nuclear plants, cooling infrastructures require massive amounts of water resources. Extraction of raw

¹¹ PRLOG. 2009: *Asia-Pacific Hydro Power Market Analysis and Forecasts to 2013*. <<http://www.prlog.org/10198289-asia-pacific-hydro-power-market-analysis-and-forecasts-to-2013.html>> Accessed 8 August 2011.

¹² Institute of Energy Economics, *Asia/World Energy Outlook 2007*. <<http://eneken.ieej.or.jp/en/data/pdf/405.pdf>>. Accessed 21 August 2011.

materials, electricity delivery, and the transport of manufactured or food products are also water-consuming processes. When considering this nexus between water, energy and food security, an approach under the precepts of sustainable and inclusive growth can reconcile these three aspects if the proper strategies and policies are implemented.

58. With growing demand for food and energy as well as rising water supply uncertainty, ensuring water, energy and food security in Asia and the Pacific will require an integrated approach linking sustainable water management, and an intensification of agricultural productivity. When considering this nexus between water availability, energy production, and food security in order to ensure sustainable and inclusive growth, an economic approach under the precepts of IWRM can be implemented. Analysing the growing requirements of food and water will involve the promotion of an integrated approach with economic legitimacy and sustainability.

59. IWRM is a holistic approach promoting sustainability by considering surface water and groundwater in quantity and quality, the interaction of water with the environment and land, and the interrelationships with social and economic development. Therefore, viewpoints of governmental and stakeholder groups, factors of the human environment, and aspects of environmental natural water systems are considered in the planning and implementation process. Due to the complexity, IWRM follows a well coordinated interdisciplinary planning process, blending knowledge from law, engineering, ecology, limnology, finance, socio-economics, politics, ethnology, history, psychology, life sciences and many other fields.

60. Since water is an issue that cuts across economic and agricultural sectors, discussions on food security and water availability should include diverse stakeholder interests, including those from governments, private and public producers and consumers, professional associations, business and the private sector, regulators, governments, non-governmental organizations, scientists, the academic community, farmers' organizations, and society at large. These stakeholders need to form a collaborative partnership to assess, understand and share the costs, risks, results and impacts of investment in water.

F. Mapping out the response to the emerging and persistent issues related to water resource management in Asia and the Pacific

1. Facing the household water security challenge: the road ESCAP is taking

61. Despite the clear health and economic benefits that hygienic sanitation facilities can provide, the regional trend in sanitation reveals that much needs to be done to come close to the Millennium Development Goal sanitation target.

62. Safe drinking water and sanitation services for human and environmental health as well as livelihood creation are the most important components of household water security. Once this access is established, sustainability issues come to the forefront. In assessing whether household needs are satisfied, international organizations and governments should adopt a more "long-term" view and consider achievements within the wider context of human dignity and long-term prosperity. For this reason, ESCAP and the Asian Development Bank (ADB) conducted a survey of sustainability in access to water supply and sanitation systems in five countries. The results warned of a possible regression in achievements because public utilities and community-

based water and sanitation systems often suffer from a multitude of maintenance and financing problems that render them unable to meet demand.

63. The results of this survey, although only indicative, point to the need for more accountability of public actors and a greater role for the private sector in that market. Community initiatives also need more support to remain financially sustainable.

64. The challenges households face in meeting their basic needs are compounded by a number of water-related environmental and socio-economic challenges. Countries, areas or ecosystems with overlapping challenges of poor access to water and sanitation, deteriorating water quality, limited water availability and increased exposure to extreme weather events and water-related disasters are referred to as “hot spots”, and the ESCAP secretariat has identified several such hot spots in Asia and the Pacific. All or some of these challenges may be of concern in any country, but a particular focus should be placed on those countries that face multiple challenges.

65. The South-East Asian countries are at crossroads of development. High growth rates provide financing for better water resources management, but development priorities ignore the risks from disasters, extreme weather events, and poor household water and sanitation access. India and Uzbekistan are also facing exceptional circumstances: India is ill prepared for natural disasters and extreme changes in weather patterns, and Uzbekistan has an unsustainable pattern of water use. In Bangladesh, basic access to sanitation remains a pivotal concern.

2. Current ESCAP initiatives on emerging issues on water resources

66. Water is a double-edged sword: it serves as an input to economic activity, especially in rapidly urbanizing areas, and is therefore an enabler of development, but, at the same time, extreme hydrologic events can damage property and cause injury or death. In addition, water can bear and transfer diseases, pollute surrounding ecosystems and cause illness and even death. Thus, it is also a threat to development.

67. In order to show the impact of extreme hydrologic and weather events on water resources in Asia and the Pacific, the secretariat included in its assessment of water hot spots an examination of vulnerability of Asia-Pacific countries to water-related weather events such as floods, cyclones, and droughts, and the level of exposure to risks. The assessment showed that more than half of the members and associate members of ESCAP are highly vulnerable and exposed to a high level of risk related to extreme hydrologic and weather events (see table 3).

Table 3
Water hot spots in Asia and the Pacific with high vulnerability and risk exposure to extreme hydrologic and weather events

Challenge	Measures available	Countries at risk
Vulnerability and risk	▪High flood risk hot spot	Australia, Bangladesh, ^b Cambodia, ^b China, ^b Democratic People's Republic of Korea, India, ^b Indonesia, ^b Iran (Islamic Republic of), Kazakhstan, ^b Kyrgyzstan, Lao People's Democratic Republic, ^b Malaysia, ^b Maldives, ^a Myanmar, ^b Nepal, Pacific islands, ^a Pakistan, Papua New Guinea, ^b Philippines, ^b Republic of Korea, Sri Lanka, Thailand, ^b Timor Leste, ^b Turkmenistan, Uzbekistan, ^b Viet Nam ^b
	▪High cyclone risk hot spot	
	▪High drought risk hot spot	
	▪Climate change pattern hot spot	

^a Challenges exist in two of the indicated measures.

^b Challenges exist in more than two of the indicated measures.

3. Integrated water resource management: closing the gaps and addressing the issues

68. IWRM is the practice of making decisions and taking action in consideration of multiple viewpoints on how to manage water in a sustainable manner. The term “water resources” includes the atmosphere, watersheds (also called drainage basins), all flowing waters in stream channels, lakes, reservoirs and ponds, wetlands, floodplains, soil moisture, snow, ice and permafrost, groundwater in aquifers, estuaries and the ocean.

69. IWRM consists of both structural measures and non-structural measures to control natural and man-made water resources systems for beneficial uses. Structural components are man-made systems for controlling water flow and quality and include conveyance systems (such as channels, canals and pipes), diversion structures, dams and storage facilities, treatment plants, pumping stations, hydroelectric plants and wells. Non-structural measures consist of policies (such as water pricing schedules), zoning laws, incentives, public relations, regulatory programmes, and insurance programmes to cover crop loss or flood damage.

70. IWRM policies and plans should reflect not only the historical record and experience of extreme events but also projected hydro-climatic conditions in order to indicate and highlight the possibility that the variability of extreme events will increase. In the context of extreme hydrologic events, IWRM plays a major role in finding solutions to the water-related challenges posed by climatic variability. It is therefore important to strengthen land and water management institutions at all levels of government so that IWRM principles can be implemented effectively, building on the principles of participation of civil society, gender equality, subsidiarity and decentralization.

71. Water utilization in most instances is seen as sectoral in nature according to its primary usage: agriculture, industry, energy and domestic use (for consumption as well as disposal of waste). The use of water by different sectors and the way in which these uses affect each other require cross-sectoral IWRM approaches. Extreme weather events affect all of these sectors, mainly through land and water systems. IWRM incorporates these individual utilization patterns as part of an ecologically based stakeholder decision-making process to guarantee the equity and sustainability of the use of the natural resource.

72. To ensure the sustainability of water resources, effective water policies, and integrated management of water resources, ESCAP is promoting IWRM as an ecologically based management tool that countries in the region can employ to address emerging and persistent issues related to water resources.

III. Plan of action

73. Given the persistent issue of access to water and sanitation and the complexity added by urbanization and extreme weather and hydrologic events, it is imperative that ESCAP further develop the path towards water-secure households in the Asia-Pacific region. Emphasis should be placed on the affordability of access to water, its reliability vis-à-vis fluctuant weather conditions or natural disasters and the convenience of the access.

74. Using the results of the regional assessment studies at the household level as a springboard to offer a wider perspective on household water security issues, ESCAP will lead the discussion on household water security issues at the second APWS. In accordance with the second APWS theme of “Water security: leadership and commitment” with emphasis on three policy priorities for water security: development, shocks and resilience, and well-being, ESCAP aims to catalyse interest and develop support for programmes concerning the improvement of sustained access to water and sanitation services for households in the Asia-Pacific region. Through the technical session, ESCAP will provide a venue for (a) identifying more specific capacity-building needs with regard to the formulation of enabling household water security policies at the national level, and (b) facilitating and mobilizing public and private institutions to support countries in addressing these needs.

75. In view of the household water security target set by ESCAP in support of the second APWS and the sixth WWF as well as the general challenges that households in the Asia-Pacific region are facing in terms of having access to safe water and basic sanitation facilities, the actions described in table 4 are planned for the immediate term (between now and the second APWS and sixth WWF, to be held in 2012), the medium term (2011-2015) and the long term (2011-2020).

76. In recognition of the pivotal roles that households play in ensuring that the Asia-Pacific region is water-secure, the ESCAP secretariat plans to implement specific, manageable, attainable, resource-constrained and time-bound strategies, which will encompass scientific research, capacity-building activities and the creation of an enabling environment to implement the most suitable and politically acceptable policies in support of the target set by ESCAP for the household water security thematic focus.

77. In the second APWS, to be held in February 2012, the ESCAP secretariat will be co-leading a sub-thematic workshop on economic and food water security. In the lead-up to the second APWS, the secretariat will organize two workshops, one on capacity-building needs assessments and the other on monitoring of investments and results in the water sector. The outputs of these workshops will assist the secretariat in planning its future programme for the benefit of member countries.

78. The Committee may wish to provide the secretariat with guidance on the direction of its future work and agenda on water resources management, particularly with respect to persistent issues associated with pollution due to rapid urbanization and intensified agriculture as well as extreme hydrologic events resulting in severe floods and droughts including the water, energy and food nexus.

Table 4

Actions aimed at reaching the household water security target* in Asia and the Pacific

Immediate term	Medium term	Long term
Increase the public's awareness of the importance of valuing limited water resources by developing and disseminating information, education, and communication (IEC) materials (e.g. brochures, online videos, booklets) across the region.	Conduct a region-wide assessment on how to create an enabling environment for the water sector, with clear rules and free of corruption, to attract sustainable water infrastructure investments, especially in the rural areas from both public and private enterprises.	Implement a cooperative agreement between and among regional institutions (governmental or non-governmental) in Asia and the Pacific in support of the 2020 water vision for the region. It is envisioned that, by 2020, households and institutions in the Asia-Pacific region will have developed not only central but peripheral awareness as well as depth of perception and coordination between and among each other in sustaining the progress made in delivering access to safe water and basic sanitation facilities to the majority of dwellers, both in rural and urban areas, in the Asia-Pacific region.
This includes "laymanization" of the results of the ESCAP household water security index and water hot spot studies.	Through funding and financing from other organizations, promote the installation of cost-effective yet less water-reliant sanitation facilities that will help reduce water contamination and promote community hygiene.	
Develop a web-based platform to initiate discussion among and between households, community leaders, government officials, and members of international organizations in identifying water-related problems and cost-effective solutions.	Through capacity-building activities, promote community-based initiatives aimed at increasing the adoption of basic sanitation and hygienic practices.	
Document best-practices in the household level in terms of adopting cost-effective yet efficient practices to gain and maintain access to safe drinking water as well as sanitation facilities.	Hold a series of workshops with all key players to clarify agency and non-agency roles, identify relevant programs, limitations, reporting needs, communication channels, and coordination needs for delivering outputs relevant to the target.	

* The household water security target is as follows: "Reduce by half the number of people who do not have access to safe drinking water and basic sanitation in the Asia-Pacific region by 2015 and to reduce that number to achieve universal and sustainable access by 2025."